

Three new species of the genus *Zethus* Fabricius, 1804 (Hymenoptera, Vespidae, Eumeninae) from China, with an updated key to the Oriental species

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Academic editor: Michael Ohl | Received 29 March 2019 | Accepted 21 June 2019 | Published 30 August 2019

<http://zoobank.org/C8F1DA4E-D17D-4BE4-850E-692815E17D76>

Citation: Wang H-C, Chen B, Li T-J (2019) Three new species of the genus *Zethus* Fabricius, 1804 (Hymenoptera, Vespidae, Eumeninae) from China, with an updated key to the Oriental species. Journal of Hymenoptera Research 71: 209–224. <https://doi.org/10.3897/jhr.71.34871>

Abstract

Three new species, namely *Zethus striatus* **sp. nov.**, *Z. asperipunctatus* **sp. nov.** and *Z. nullimarginatus* **sp. nov.** from China are described and illustrated. *Z. tumidus* Nguyen & Carpenter, 2016 and *Z. angulatus* Nguyen & Carpenter, 2016 are newly recorded from China. An updated key to the Oriental species of the genus is provided.

Keywords

Zethus, Eumeninae, China, new species, new records

Introduction

Zethus Fabricius, 1804 is the most species-rich genus within the subfamily Eumeninae with 275 valid species, containing four subgenera: *Madecazethus* Giordani Soika, *Zethoides* Fox, *Zethus* Fabricius and *Zethusculus* Saussure, among

which *Madecazethus* is endemic to Madagascar with two species, both *Zethoides* and *Zethusculus* are restricted to the Neotropical and Nearctic regions, and the subgenus *Zethus* Fabricius is widely distributed worldwide excluding the Australian region (Bohart and Stange 1965; Giordani Soika 1979; Gusenleitner 2011; Pannure et al. 2016, 2018; Yeh and Lu 2017; Hermes and Lopes 2018; Tan et al. 2018). So far, there are 26 described species in the Oriental region. The first review on the Oriental *Zethus* concluding a key to six recognized species was given and then an updated key to eight species was provided (Giordani Soika 1941, 1958). In the following 60 years, eighteen more species were found and described, respectively (Giordani Soika 1995; Gusenleitner 1988, 2001, 2007, 2010; Gusenleitner and Gusenleitner 2013; Nguyen and Carpenter 2016, Nguyen and Xu 2017; Selis 2017, 2018; Yeh and Lu 2017; Tan et al. 2018). In our study of the genus *Zethus*, we systematically sorted out all of the references to the Oriental species. Based on the references and the specimens which were long-term collection throughout China by us and other Chinese museums, a key to the Oriental species are updated and three species are new to science. In addition, both *Z. tumidus* Nguyen & Carpenter and *Z. angulatus* Nguyen & Carpenter are recorded firstly from China.

Materials and methods

The pinned specimens examined were collected by using an insect net. Those specimens are deposited in Chongqing Normal University, Chongqing, China (CQNU), Central South University of Forestry and Technology, Changsha, China (CSUFT), Museum of Hebei University, Baoding, China (MHBUE), Shanghai Entomological Museum C.A.S, Shanghai, China (SEM). Descriptions and measurements were made under a stereomicroscope (Olympus SZ61). All figures were taken with Keyence VHX-5000 digital microscope and Photoshop CS 6 was used to make the plates. Body length was measured from the anterior margin of the head to the posterior margin of metasomal tergum 2. For the density description of punctures, “sparse” means that distance is larger than punctures diameter and “dense” means less than the diameter. Terminology principally follows Bohart and Stange (1965) and Yamane (1990). The abbreviations used in this paper are shown as follows:

AE broadened apical expansion of metasomal sternum 1

BS slender basal stem of metasomal sternum 1

A1 for antennal segment 1,

A2 for antennal segment 2,

T1 for metasomal tergum 1,

T2 for metasomal tergum 2,

S1 for metasomal sternum 1,

S2 for metasomal sternum 2, and so on.

Taxonomy

Zethus Fabricius, 1804

Zethus Fabricius, 1804: xii, 282. **Type species:** “*Zethus coeruleo-pennis* Fab.” [= *Vespa coeruleopennis* Fabricius, 1798], by subsequent designation of Latreille, 1810: 328, 438.

Zethus striatus Wang & Li, sp. nov.

<http://zoobank.org/AEB232FA-2A87-4419-8189-F50AFD58276E>

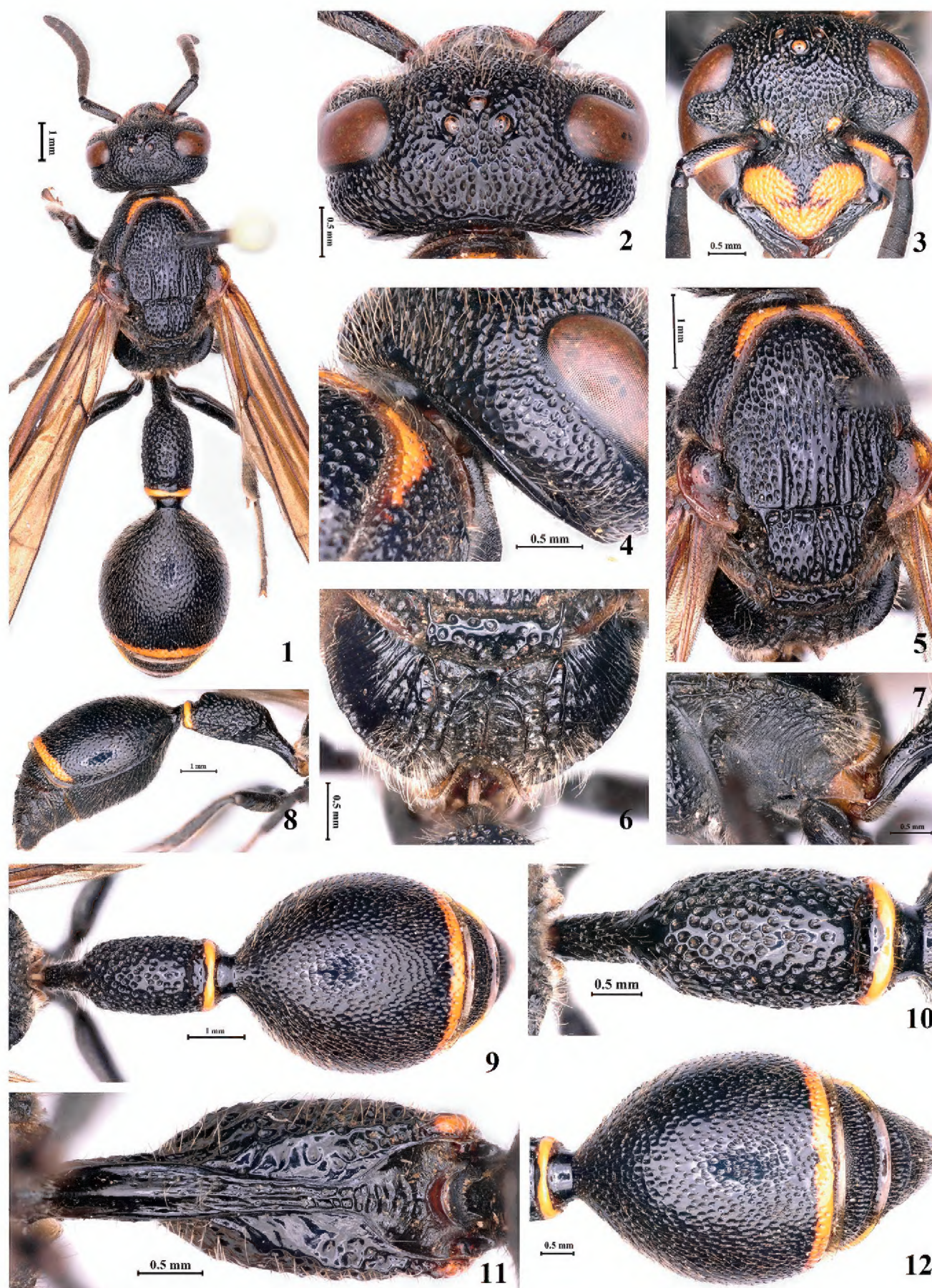
Figs 1–12

Material examined. Holotype, ♀: CHINA, Guangxi, Baise City, Tianlin County, CengWangLaoShan National Nature Reserve, Dalongping, 24°29.361'N, 106°24.076'E, 24–25.VIII.2007, Xiang Li leg. (CQNU).

Description. Female: body length 15.3 mm (Fig. 1), fore wing length 13.7 mm. Black, the following parts yellow: clypeus except base and central middle, spot on dorso-inner margin of antennal socket, antennal scape ventrally, paired transverse middle spots on dorsal side of pronotum, apical bands on T1 and T2; tegula dark brown (Fig. 5).

Head. Head with short setae, their length slightly longer than posterior ocellar diameter; head about 2.1× wider than long in dorsal view (Fig. 2), wider than high in frontal view, about 1.2× as wide as high (Fig. 3); mandible with four blunt teeth and short setae; clypeus convex in lateral view and about 1.3× as wide as high in frontal view, with basal margin nearly straight, apical margin of clypeus frontally truncated and laterally cambered, clypeus punctate-reticulate with sparse setae (Fig. 3); frons with sparse setae and dense punctures; vertex and gena with dense punctures; gena in lateral view as wide as eye, without longitudinal carina; distance from posterior ocelli to apical margin of vertex 1.7× as long as distance from posterior ocelli to inner eye margin (Fig. 2); occipital carina developed laterally and weak dorsally (Fig. 4); antennal scape 3× as long as its maximum width, A3 1.4× as long as its maximum width, A4 as long as its maximum width, A5–11 wider than long, A12 bullet-shaped, as long as its basal width.

Mesosoma. Length of mesosoma about 1.3× as long as wide in dorsal view (Fig. 5); pronotal carina weak laterally and indistinct dorsally, pronotum with dense punctures and slightly reticulate dorsally; notaulix distinct on basal half of mesoscutum, mesoscutum with deep and dense punctures, area between punctures striate, in lateral view weakly convex; tegula smooth, with very sparse punctures, its posterior lobe triangular and well developed which exceeds parategula posteriorly; epicnemial carina distinct; mesopleura with deep and dense punctures, slightly sparse ventrally; scutellum flattened, with deep and dense punctures, area between punctures striate, longitudinal furrow on the middle of scutellum (Fig. 5); metanotum sloping down posteriorly, with deep punctures; metapleuron almost smooth; propodeum (Fig. 6) with strong



Figures 1–12. *Zethus striatus* sp. nov., holotype **1** habitus in dorsal view, ♀ **2** vertex, ♀ **3** head in frontal view, ♀ **4** vertex in dorsal-lateral view, ♀ **5** mesosoma, ♀ **6** propodeum in dorsal view, ♀ **7** propodeum in lateral view, ♀ **8** metasoma in lateral view, ♀ **9** metasoma in dorsal view, ♀ **10** T1, ♀ **11** S1, ♀ **12** T2, ♀.

striae and lateral carina, its dorsolateral surface with distinct and oblique striae and strong longitudinal carina along submedian carina, posterior surface of propodeum with transverse striae along median carina, submarginal carina produced into lamella above propodeal valvulae, its lateral surface with punctures along lateral carina and weak striae on its lower half (Fig. 7); orifice more or less angled dorsally (Fig. 6).

Metasoma. T1 about $2.5\times$ as long as wide in dorsal view, gradually widening from one-third of the base, then nearly parallel-sided apically, with maximum width $3\times$ its basal width, without medial carina, T1 with deep and dense macropunctures and sparse setae (Fig. 10), lateral carina of T1 present in ventral view (Fig. 11); BS of S1 with median longitudinal carina and narrow from its middle to apex, coarsely punctate on apical margin of BS and base half of AE (Fig. 11); T2 without petiole and with developed apical lamella, about $1.2\times$ as long as wide in dorsal view, T2 with deep and dense punctures (Fig. 12); S2 swollen from the base to near midpoint, subsequent portion nearly straight in profile (Fig. 8), its apical margin with lamella; T3 with developed and raised apical lamella (Figs 8, 9, 12); subsequent terga and sterna with deep punctures, but slightly smaller than those on T2.

Male. Unknown.

Distribution. China: Guangxi.

Remarks. The species is similar to *Z. trimaculatus* Cameron, 1904 from Vietnam, Laos and India by the characters: body with dense punctures (Fig. 1), occipital carina developed laterally and weak dorsally (Fig. 4), pronotal carina weak laterally and indistinct dorsally (Fig. 5), S2 not tuberculate in profile (Fig. 8). It differs from *Z. trimaculatus* and all other members of the genus by the following character combination: apex of clypeus yellow, apical margin of clypeus frontally truncated (Fig. 3) and laterally cambered, BS of S1 with longitudinal carina (Fig. 11), propodeum with strong lateral carina and its dorsolateral and posterior surface with strong striae (Fig. 6).

Etymology. The specific name *striatus* is derived from Latin word: *striatus*, referring to propodeum with strong striae in dorsal view.

***Zethus asperipunctatus* Wang & Li, sp. nov.**

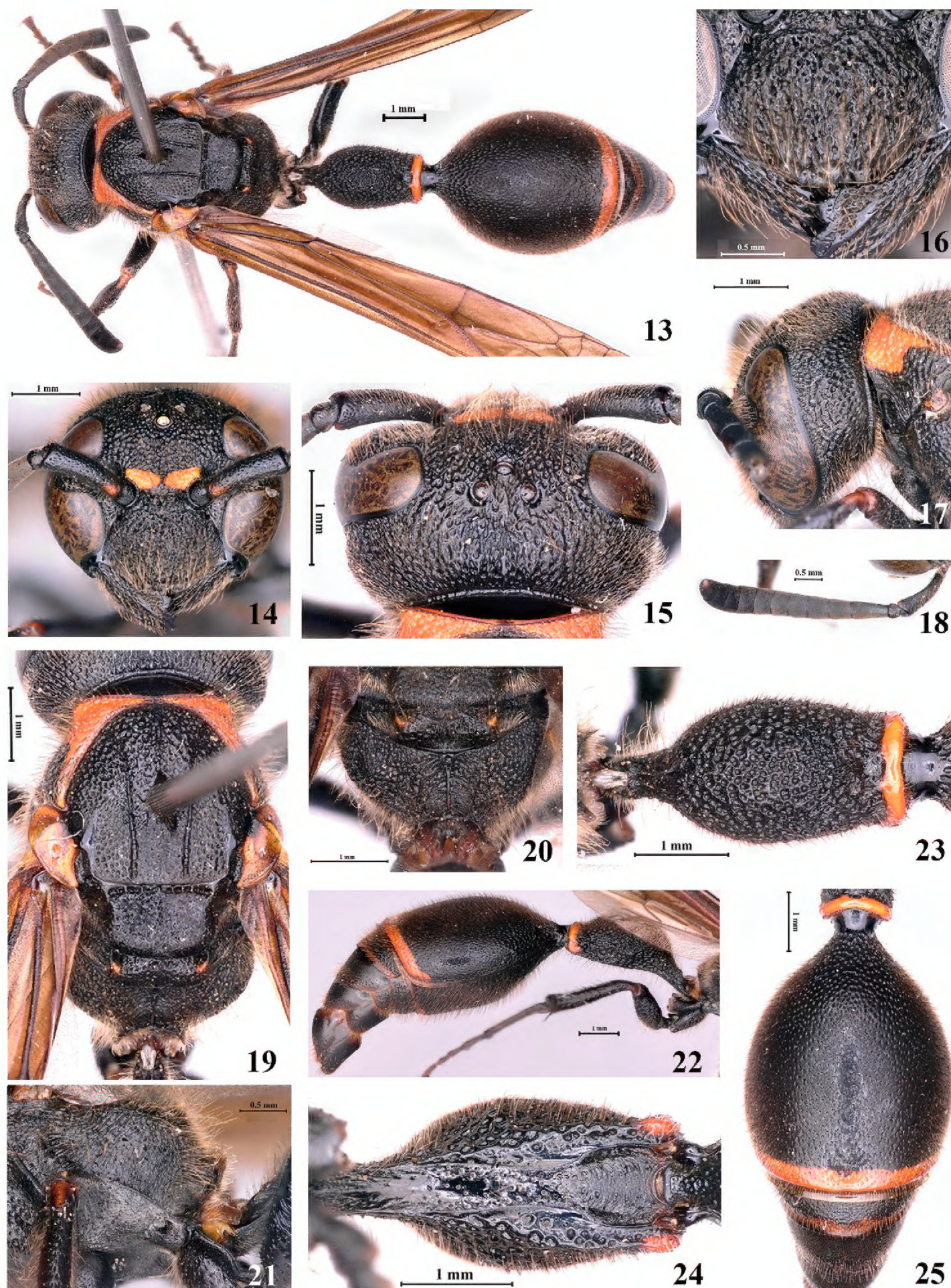
<http://zoobank.org/5CB359C4-C337-461C-8224-A42D274B3BD5>

Figs 13–25

Material examined. Holotype, ♀: CHINA, Yunnan, Lijiang City, Yulong County, Hutiaoxia, $27^{\circ}22.953'N$, $99^{\circ}53.157'E$, 7.VI.2009, Meicai Wei leg. (CSUFT).

Description. Female: body length 16.2 mm (Fig. 13), fore wing length 13.7 mm. Black, the following parts ferruginous: marking on dorso-inner margin of antennal socket, antennal scape lower area ventrally, pronotum in dorsal view, tegula, dot on lateral of metanotum, apical bands on T1, T2, T3 and middle of S2 (Fig. 13).

Head. Head with long setae, their length distinctly longer than $2\times$ posterior ocellar diameter; head about $1.3\times$ as wide as high in frontal view (Fig. 14), about $1.7\times$ wider than long in dorsal view (Fig. 15); mandible with four blunt teeth and dense setae, its outer surface with coarse punctures; clypeus convex in lateral view and about $1.3\times$ as wide as high in frontal view, with basal margin almost straight, minutely bi-dentate apically, depressed space between teeth with a median carina, width of truncation $1/3\times$ width of clypeus between inner eye margins, clypeus with dense and long setae and dense punctures (Fig. 16); frons with long setae and dense punctures; vertex and gena with dense punctures; gena slightly wider than eye in lateral view and without longi-



Figures 13–25. *Zethus asperipunctatus* sp. nov., holotype **13** habitus in dorsal view, ♀ **14** head in frontal view, ♀ **15** vertex, ♀ **16** clypeus, ♀ **17** gena, ♀ **18** antenna, ♀ **19** mesosoma, ♀ **20** propodeum in dorsal view, ♀ **21** propodeum in lateral view, ♀ **22** metasoma in lateral view, ♀ **23** T1, ♀ **24** S1, ♀ **25** T2, ♀.

tudinal carina (Fig. 17); distance from posterior ocelli to apical margin of vertex 1.7× as long as distance from posterior ocelli to inner eye margin (Fig. 15); occipital carina complete (Fig. 15); antennal scape 2.7× as long as its apical width, A3 1.8× as long as

its maximum width, A4 slightly longer than its maximum width, A5–11 wider than long, A12 bullet-shaped, as long as its basal width (Fig. 18).

Mesosoma. Length of mesosoma about $1.3\times$ as long as wide in dorsal view (Fig. 19); pronotal carina complete, pronotum with distinct humeral angle and reticulate punctures dorsally; notaulix complete, mesoscutum with dense punctures, gradually shallow from the anterior to posterior portion; tegula smooth, with dense and short setae on its anterior and posterior lobe; epicnemial carina distinct; mesopleura with deep and dense punctures; scutellum flattened, and with shallow punctures and middle longitudinal furrow almost invisible, distance between punctures about as wide as punctures diameter; punctures on metanotum like those on scutellum, but deeper; metapleuron almost smooth; propodeum dull, with lateral carina and without submedian carina, its dorsolateral surface with reticulate striae (Fig. 20), submarginal carina produced into lamella above propodeal valvulae, lateral surface of propodeum with sparse and fine punctures (Fig. 21); orifice angled dorsally (Fig. 20).

Metasoma. T1 about $2.2\times$ as long as wide, with medial carina from basal margin to one-third of the tergum, gradually widening from one-fourth of the base, then narrowly toward apex, with maximum width about $3.3\times$ its basal width, T1 with coarse and dense punctures (Fig. 23) and lateral carina of T1 present wholly (Fig. 24); BS of S1 without longitudinal carina and with sparse punctures, lateral portion of AE with weak striae and sporadic punctures (Fig. 24); T2 without distinct petiole, gradually swollen from the base to midpoint and nearly straight to apex in lateral view, with developed apical lamella, about $1.3\times$ as long as wide in dorsal view, T2 with dense punctures, which gradually sparse from the base to apex, distance between punctures on the base distinctly less than its diameter and $1\text{--}2\times$ larger than puncture diameter on apical margin (Fig. 25); S2 swollen from the base to near midpoint, subsequent portion nearly straight in profile (Fig. 22), punctures on the base of S2 large, punctures on subsequent portion like those on T2, but punctures on lateral portion dense, apical margin of S2 with lamella, T3 and S3 with dense and small punctures, T3 with thick apical lamella, and subsequent terga and sterna with small punctures, distance between punctures about as wide as its diameter.

Male. Unknown.

Distribution. China: Yunnan.

Remarks. This new species resembles *Z. nigerrimus* Gusenleitner, 2001 from China, Malaysia, Laos and Vietnam, with which it has the following common characters: clypeus minutely bi-dentate apically, depressed space between teeth with a median ridge (Fig. 16), T1 about $2.2\times$ as long as wide (Fig. 23), T2 without distinct petiole (Fig. 25), S2 not tuberculate in profile (Fig. 22). It differs from *Z. nigerrimus* and all other members of the genus by the following character combination: body with ferruginous marking (Fig. 13), gena without carina (Fig. 17); BS of S1 with sparse punctures (Fig. 24), S2 blunt angulate in profile (Fig. 22), and propodeum and metasoma dull and with dense setae and punctures (Figs 13, 21, 22).

Etymology. The specific name *asperipunctatus* is derived from two Latin words: *asper* and *punctatus*, referring to metasoma dull and with dense punctures.

***Zethus nullimarginatus* Wang & Li, sp. nov.**

<http://zoobank.org/AF713936-6F3B-48B5-9B43-1DA9BE727159>

Figs 26–35

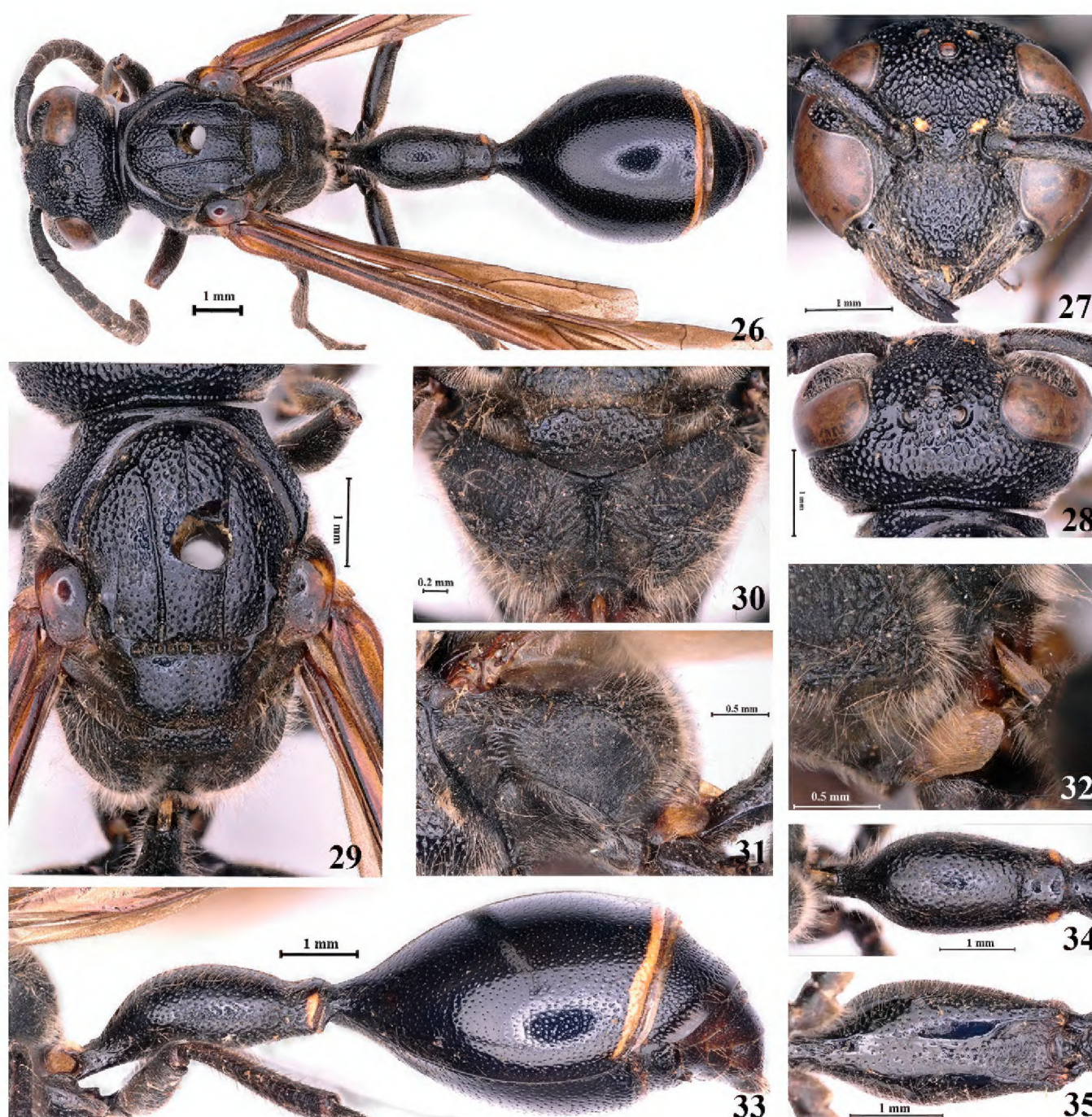
Material examined. Holotype, ♀: CHINA, Fujian, Longyan City, Changting County, Sidu Town, 25°39.126'N, 116°12.253'E, 1.V.1951, Gentao Jin & Yangming Lin leg. (SEM).

Description. Female: body length 15.2 mm (Fig. 26), fore wing length 13.5 mm. Almost black, the following parts yellow: spot on dorso-inner margin of antennal socket (Fig. 27), apical interrupted band on T1, apical complete band on T2; tegula dark brown (Fig. 29).

Head. Head wider than high, about 1.3× as wide as high in frontal view (Fig. 27), about 1.8× wider than long in dorsal view (Fig. 28); mandible with four teeth and dense setae, its outer surface with irregular punctures; clypeus convex in lateral view and about 1.6× as wide as high, with basal margin straight, apical margin near truncated, width of truncation 1/3× width of clypeus between inner eye margins, clypeus punctate-reticulate with dense long setae (Fig. 27); punctures on frons reticulate; vertex and gena with dense punctures; gena without longitudinal carina in lateral view; distance from posterior ocelli to apical margin of vertex 1.8× as long as distance from posterior ocelli to inner eye margin (Fig. 28); occipital carina complete (Fig. 28); antennal scape 2.8× as long as its maximum width, A3 1.7× as long as its maximum width, A4 slightly longer than its maximum width, A5–11 wider than long, A12 bullet-shaped, slightly longer than its basal width.

Mesosoma. Length of mesosoma about 1.4× as long as wide in dorsal view (Fig. 29); pronotal carina complete and developed, pronotum with coarse punctures dorsally, weak striae in lower lateral surface; notaulix complete, mesoscutum with dense punctures, gradually shallow from the anterior to posterior portion (Fig. 29); tegula smooth, with dense and short setae on its anterior and posterior lobe, its posterior lobe truncated (Fig. 29); mesopleura with dense punctures, slightly sparse ventrally; scutellum flattened, and with shallow punctures and weak middle longitudinal furrow; punctures on metanotum dense and coarse; metapleuron smooth; propodeum dull, with coarse surface in dorsal view and lateral carina very weak, without submedian carina (Fig. 30), its lateral surface with sporadic punctures and without striae (Fig. 31), submarginal lamella almost absent above propodeal valvulae (Fig. 32).

Metasoma. T1 about 2.5× as long as wide, with medial carina from basal margin to one-fourth of tergum, gradually widening from one-fifth of the base, then distinctly narrow toward apex, with maximum width 3× its basal width, T1 with punctures, distance between punctures about equal to the diameter (Fig. 34), lateral carina of T1 disappeared ventrally (Fig. 35); BS of S1 with sparse punctures, AE of S1 with weak and irregular striae and sporadic punctures (Fig. 35); T2 gradually swollen from the base to apical margin in lateral view, with developed apical lamella, about 1.2× as long as wide in dorsal view, T2 with sparse punctures, area between punctures with fine punctures, distance between punctures 1–2× larger than puncture diameter (Fig. 33); S2 gradually swollen from basal to apical margin in profile (Fig. 33); punctures on S2 slightly larger than those on T2, punctures on center area of S2 sparse, S2 with apical lamella; T3 with



Figures 26–35. *Zethus nullimarginatus* sp. nov., holotype **26** habitus in dorsal view, ♀ **27** head in frontal view, ♀ **28** vertex, ♀ **29** mesosoma, ♀ **30** propodeum in dorsal view, ♀ **31** propodeum in lateral view, ♀ **32** propodeum in dorsal-lateral view, ♀ **33** metasoma in lateral view, ♀ **34** T1, ♀ **35** S1, ♀.

dense punctures and thick apical lamella; apical margin of S3 with dense punctures like those on T3; subsequent terga and sterna with slightly sparse micropunctures.

Male. Unknown.

Distribution. China: Fujian.

Remarks. The species resembles *Z. velamellatus* Tan, 2018 from Zhejiang, China by propodeum without submarginal lamella (Fig. 32), S2 gradually swollen from basal to apical margin in profile (Fig. 33). It differs from *Z. velamellatus* and all other members of the genus by the following character combination: apical margin of clypeus truncated (Fig. 27), the posterior lobe of tegula truncated (Fig. 29), propodeum without submarginal lamella (Fig. 32), T1 about 2.5× as long as wide, narrowly toward apex (Fig. 34), lateral carina of T1 disappeared ventrally (Fig. 35).

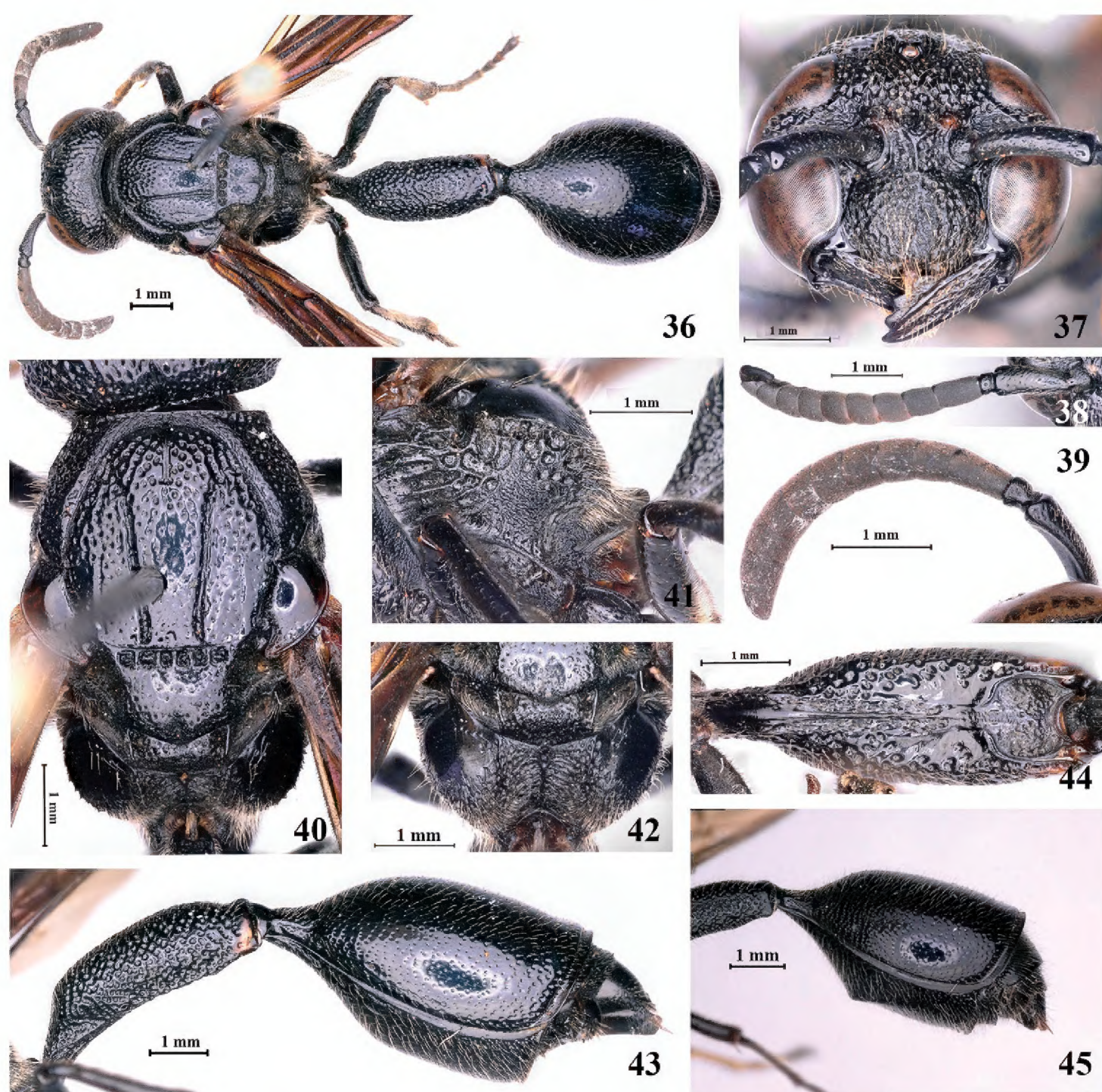
Etymology. The specific name *nullimarginatus* is derived from two Latin words: *null* and *marginatus*, referring to lateral carina of T1 disappeared ventrally.

***Zethus angulatus* Nguyen & Carpenter, 2016, new record**

Figs 36–44

Zethus angulatus Nguyen & Carpenter, 2016: 27.

Material examined. 1♀: CHINA, Guangxi, Guilin City, Xingan County, Gaozhai Village, 25°50.901'N, 110°28.976'E, 19.VII.2015, Tingjing Li leg. (CQNU); 1♀: CHINA, Guangxi, Hechi City, Huanjiang County, Chuanshan Town, Linglang Village, 25°1.385'N, 108°5.761'E, 22.VII.2018, Qian Han et al. leg. (CQNU); 1♂: CHINA, Guangdong, Shaoguan City, Shixing County, CheBaLing National Nature Reserve, 24°43.503'N, 114°15.658'E, 22.VII.2018, Chengqiang Wang leg. (CQNU).



Figures 36–45. *Zethus angulatus* Nguyen & Carpenter, 2016 **36** habitus in lateral view, ♀ **37** head in frontal view, ♀ **38** antenna, ♂ **39** antenna, ♀ **40** mesosoma, ♀ **41** propodeum in lateral view, ♀ **42** propodeum in dorsal view, ♀ **43** metasoma in lateral view, ♀ **44** S1, ♀ **45**. *Zethus dolosus* Bingham, 1897, mesosomal segment 2 in lateral view, ♀.

Diagnosis. Female (Fig. 36): black, with the following parts yellow: spot on near dorso-inner margin of antennal socket and lateral carina of T1. Clypeus emarginated at basal and apical margin, clypeus punctate-reticulate and with long setae (Fig. 37); A12 bullet-shaped (Fig. 39); notaulix complete, punctures on mesoscutum gradually shallow from the anterior to posterior portion (Fig. 40); scutellum with punctures and middle longitudinal furrow; metapleuron with transverse striae; propodeum with lateral carina (Fig. 41) and transverse striae along median carina (Fig. 42), its lateral surface with large punctures in upper half (Fig. 41). T1 about 3× as long as wide in dorsal view, slightly narrow toward apical margin, T1 with coarse and deep punctures (Fig. 43); BS of S1 with longitudinal carina (Fig. 44), T2 with apical lamella, punctures on the near base of T2 denser and larger than other portion of tergum (Fig. 43); S2 with short apical lamella and obtuse angle in lateral view (Fig. 43); punctures on T3 and S3 dense and deep, T3 with thick apical lamella.

Male: structure as in female, but differing as follows: longitudinal pale yellow stripe on mandible, apical margin of clypeus deeply emarginated with the emargination forming a semicircle, A13 elongate, slightly curved (Fig. 38), propodeum with strong and oblique striae along median carina.

Distribution. China: Guangdong and Guangxi (**new record**); Vietnam.

Zethus tumidus Nguyen & Carpenter, 2016, new record

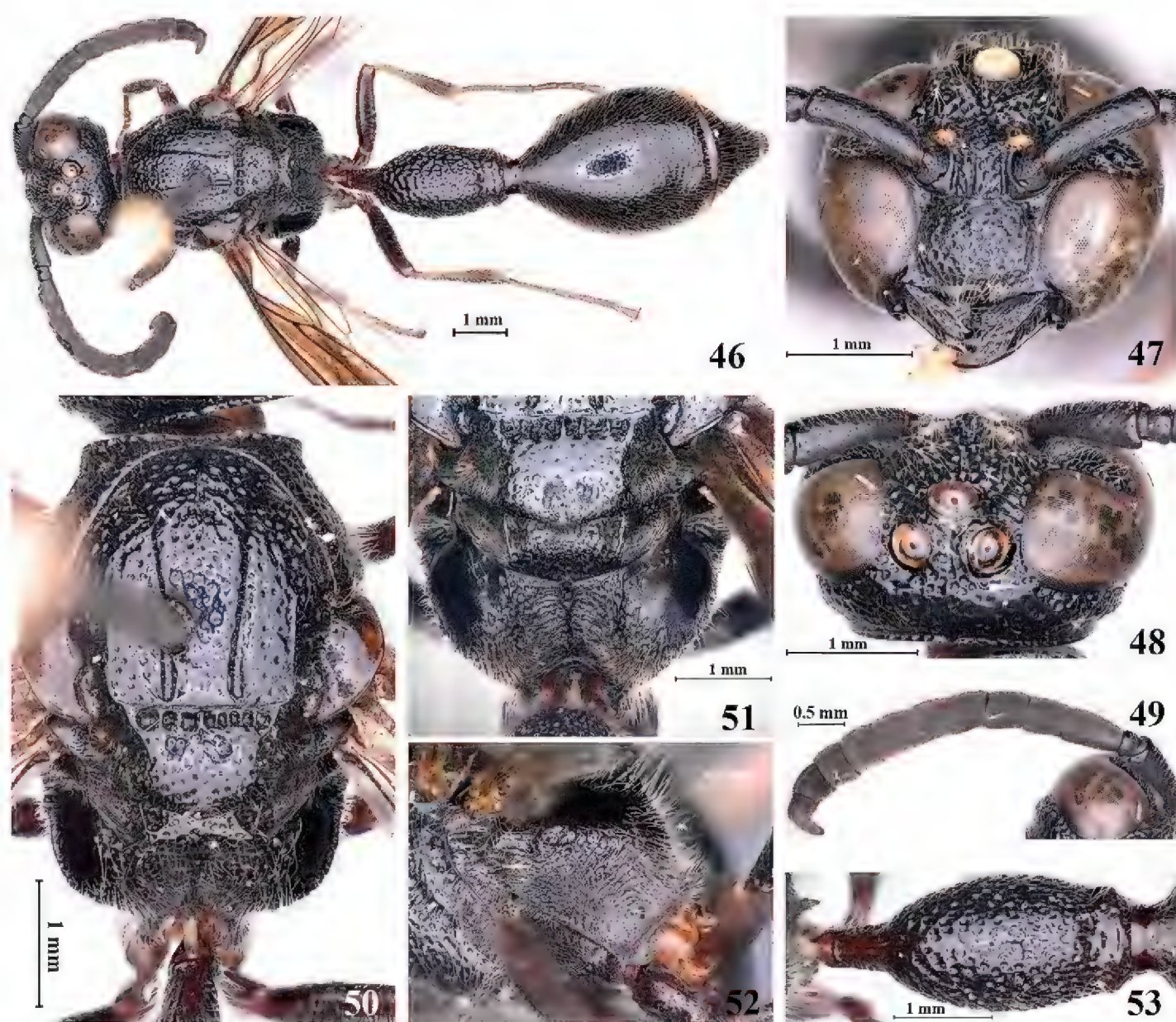
Figs 46–53

Zethus tumidus Nguyen & Carpenter, 2016: 29.

Material examined. 1♂: CHINA, Hainan, Changjiang County, Bawangling, 19°07.270'N, 109°05.009'E, 11–12.VII.2007, Yibin Ba & Juntong Lang leg. (MHBU).

Diagnosis. Male (Fig. 46): black, with yellow spot on dorso-inner margin of antennal socket and brown on S1 and the base of S2. Clypeus with reticulate punctures, apical margin distinctly emarginated (Fig. 47); ocelli large, its diameter as wide as antennal socket (Figs 47, 48); occipital carina complete (Fig. 48); A13 elongated (Fig. 49). Notaulix developed, mesoscutum with distinct punctures (Fig. 50); propodeum with lateral carina (Fig. 51), submarginal carina produced into developed lamella, its lateral surface without distinct punctures and striae and with deep and large punctures along lateral carina (Fig. 52). T1 2.4× as long as wide in dorsal view, maximum width 3× its basal width, then narrowly toward apical margin, with a medial carina which runs from basal margin to one-third of tergum, punctures on T1 large and dense (Fig. 53); BS of S1 with irregular and longitudinal striae; T2 with slightly dense punctures; T2 and S2 in lateral view gradually convex from basal to apical margin, with developed apical lamella; T3 and S3 with dense punctures; T3 with thick apical lamella.

Distribution. China: Hainan (**new record**); Vietnam.



Figures 46–53. *Zethus tumidus* Nguyen & Carpenter, 2016 **46** habitus in dorsal view, ♂ **47** head in frontal view **48** vertex **49** antenna **50** mesosoma **51** propodeum in dorsal view **52** propodeum in lateral view **53** T1.

Key to species of the genus *Zethus* from the Oriental region

- 1 T1 about 5× as long as wide in dorsal view *Z. fulgens* Gusenleitner, 2007
- T1 at most 4.2× as long as wide in dorsal view (Figs 10, 23, 34, 43, 53) 2
- 2 Head and mesosoma with dense and long golden orange setae 3
- Head and mesosoma without dense golden orange setae 5
- 3 Apical lamella of T3 indistinct; mesoscutum with large and dense punctures
..... *Z. celebensis* Giordani Soika, 1958
- Apical lamella of T3 distinct; mesoscutum with indistinct punctures 4
- 4 S2 with developed lamella; in female, apical margin of S3 with a punctate median lobe; in male, antennae black, apical flagellomere rounded apically; apical margin of clypeus without teeth *Z. soikai* Selis, 2017
- S2 without apical lamella; in female, apical margin of S3 without lobe; in male, antennae orange, apical flagellomere pointed apically; apical margin of clypeus with two triangular teeth *Z. luzonensis* Giordani Soika, 1941

- 5 S2 not tuberculate in lateral view (Figs 8, 22, 33, 43).....6
- S2 tuberculate in lateral view (Fig. 45)22
- 6 Both T2 and T3 without lamellae
..... ***Z. puehringeri* Gusenleitner & Gusenleitner, 2013**
- Both T2 and T3 with lamellae (Figs 12, 25, 33, 43, 45, 46).....7
- 7 Submarginal lamella of propodeum absent (Fig. 32)8
- Submarginal lamella of propodeum present (Figs 7, 21, 41, 52).....9
- 8 Apical margin of clypeus without depressed space and lateral tooth (Fig. 27); lateral carina of T1 disappeared in ventral view (Fig. 35) ***Z. nullimarginatus* sp. nov.**
- Apical margin of clypeus with depressed space between lateral tooth; lateral carina of T1 present in ventral view.....***Z. velamellatus* Tan, 2018**
- 9 Occipital carina developed laterally, weak dorsally (Fig. 4); pronotal carina almost indiscernible dorsally (Fig. 5)10
- Occipital carina and pronotal carina complete and visible (Figs 19, 29, 40, 50) ...11
- 10 Apical margin of clypeus emarginated; propodeum with weak lateral carina.....
..... ***Z. trimaculatus* Cameron, 1904**
- Apical margin of clypeus frontally truncated and laterally cambered (Fig. 3); propodeum with strong lateral carina (Fig. 6).....***Z. striatus* sp. nov.**
- 11 Apical margin of clypeus almost truncated or rounded (Figs 16, 27)12
- Apical margin of clypeus distinctly emarginated (Figs 47, 37)19
- 12 T1 at least 3.5× as long as wide in dorsal view.....13
- T1 at most 2.6× as long as wide in dorsal view (Figs 23, 34, 53)16
- 13 Metapleuron with strong and short striae.....14
- Metapleuron without striae.....15
- 14 Scutellum with weak longitudinal furrow in middle
..... ***Z. malayanus* Gusenleitner, 2010**
- Scutellum with deep longitudinal furrow on the apex behind
..... ***Z. quadridentatus* Cameron, 1902**
- 15 Tegula and leg ferruginous; T1 narrowly toward apical margin
..... ***Z. varipunctatus* Cameron, 1902**
- Tegula and leg black; T1 nearly parallel-sided apically.....
..... ***Z. planiclypeus* Gusenleitner, 1988**
- 16 T2 without distinct petiole (Fig. 25)17
- T2 with petiole18
- 17 Mesosoma and metasoma almost black; gena with a longitudinal carina
..... ***Z. nigerrimus* Gusenleitner, 2001**
- Mesosoma and metasoma with ferruginous marking (Fig. 13); gena without longitudinal carina (Fig. 17)..... ***Z. asperipunctatus* sp. nov.**
- 18 T1 gradually widening from one-sixth from the base, with medial carina from basal margin to near apical margin; submarginal carina of propodeum produced into pointed lamella..... ***Z. nanlingensis* Nguyen & Xu, 2017**
- T1 gradually widening from one-fourth from the base, with medial carina from basal margin to one-fourth of tergum; submarginal carina of propodeum pro-

- duced into round and short lamella.....
..... ***Z. propodeus* Nguyen & Carpenter, 2016**
- 19 T1 about 3× as long as wide in dorsal view
..... ***Z. angulatus* Nguyen & Carpenter, 2016**
- T1 less than 2.5× as long as wide in dorsal view20
- 20 A3 2× as long as wide; ocellar diameter as wide as antennal socket (Fig. 47).....
..... ***Z. tumidus* Nguyen & Carpenter, 2016**
- A3 less than 2× its width; ocellar diameter narrower than antennal socket.....21
- 21 Gena without longitudinal carina; in male, mandible separated from middle
tooth by a broad notch; clypeus black ***Z. taiwanus* Yeh & Lu, 2017**
- Gena with a longitudinal carina; in male, mandible not separated by a broad
notch; clypeus with yellow marking.... ***Z. tansoneus* Nguyen & Carpenter, 2016**
- 22 T1 swollen at the base, with lateral margins narrowly toward apex.....23
- T1, subcylindrical, nearly parallel-sided apically.....25
- 23 Propodeum without lateral carina ***Z. bakeri* Giordani Soika, 1995**
- Propodeum with lateral carina24
- 24 A13 slightly curved; punctures on T2 large and slightly sparse; clypeus with yel-
low marking..... ***Z. mandibularis* Giordani Soika, 1995**
- A13 straight; punctures on T2 fine and dense; clypeus black.....
..... ***Z. malabarica* Giordani Soika, 1995**
- 25 Apical lamella of the S2 not reaching the lateral margins of the same sternum
..... ***Z. ceylonicus* de Saussure, 1867**
- Apical lamella of the S2 reaching the lateral margins of the same sternum.....26
- 26 Body glossy and almost without punctures.... ***Z. improcerus* Giordani Soika, 1995**
- Body with coarse and wide punctures27
- 27 Lateral surface of propodeum with oblique striae in the lower half.....
..... ***Z. dolosus* Bingham, 1897**
- Lateral surface of propodeum smooth in lower half.....28
- 28 Metasomal segments 3–6 with long and dense setae.....
..... ***Z. albopilosus* Giordani Soika, 1995**
- Metasomal segments 3–6 with short and sparse setae
..... ***Z. indicus* Giordani Soika, 1958**

Acknowledgements

We are very grateful to Prof. James M. Carpenter (American Museum of Natural History, New York, USA) and Dr. P. Girish Kumar (Western Ghat Regional Centre, Zoological Survey of India, Kozhikode, India) for providing copies of many references. We sincerely thank Prof. Meicai Wei (Central South University of Forestry and Technology, Changsha, China), Prof. Guodong Ren (Museum of Hebei University, Baoding, China) and Prof. Haisheng Yin (Shanghai Entomological Museum C.A.S., Shanghai,

China). This study was funded by the National Natural Science Foundation of China (Nos: 31772490, 31372247, 31000976), Young Talent Incubation Programme of Chongqing Normal University (14CSDG07).

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